

# DUO-THERM



## OWNER'S MANUAL

# 65900 Series

WITH MODEL SUFFIX -054 and -056

## AC DC & DC Only/ PILOT MODELS

### GAS DIRECT-VENT FORCED AIR FURNACES FOR MOBILE HOMES OR RECREATIONAL VEHICLES



**UNDERWRITERS  
LABORATORIES**

LISTED

INC. ®



Children and adults should be alerted to the hazards of high surface temperatures and should stay away to avoid burns or clothing ignition.

Young children should be carefully supervised when they are in the same room as the appliance.

Clothing or other flammable material should not be placed on or near the appliance.

#### FOR YOUR SAFETY

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this appliance.

#### FOR YOUR SAFETY

If you smell gas:

1. Open windows
2. Don't touch electrical switches
3. Extinguish any open flame
4. Vacate premises until ventilation is complete and gas source is found and corrected.
5. Immediately call your gas supplier

**IMPORTANT INSTRUCTIONS  
MUST STAY WITH UNIT  
OWNER - READ CAREFULLY**

## WARNING

THIS UNIT MUST BE SERVICED ONLY BY AN AUTHORIZED SERVICEMAN. MODIFICATION OF THE APPLIANCE CAN BE EXTREMELY HAZARDOUS AND COULD LEAD TO SERIOUS INJURY OR DEATH.

FUEL BURNING APPLIANCES GENERATE TOXIC FLUE PRODUCTS. MODIFICATION OR IMPROPER MAINTENANCE CAN CAUSE CARBON MONOXIDE IN DEADLY AMOUNTS. TO PREVENT THIS, MAINTAIN APPLIANCE IN SAFE OPERATING CONDITION.

**DO NOT** BLOCK OR MODIFY ANY COMBUSTION AIR OR FLUE GAS PASSAGEWAYS.

**DO NOT** ADD ANY DEVICES OR ACCESSORIES TO THIS APPLIANCE EXCEPT THOSE SPECIFICALLY AUTHORIZED BY DUO-THERM.

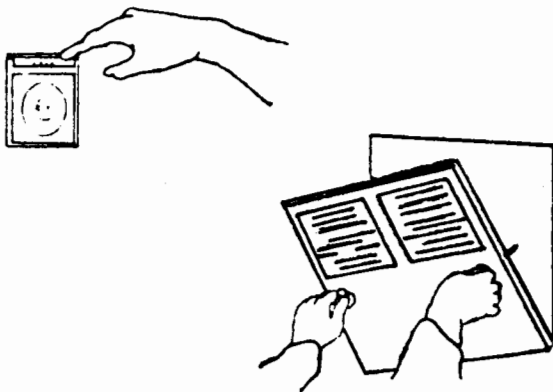
**ALWAYS** CONSULT YOUR AUTHORIZED SERVICEMAN FOR ANY PROBLEMS OR QUESTIONS YOU MAY HAVE PERTAINING TO THIS APPLIANCE.

**ALWAYS** INSPECT THE APPLIANCE BEFORE STARTING A NEW HEATING SEASON, PAYING SPECIAL ATTENTION TO COMBUSTION AIR, FLUE GAS PASSAGEWAYS AND FUEL LINES.

**THE DUO-THERM® CORPORATION**  
509 South Poplar Street  
LaGrange, IN 46761-2399

**A** Set thermostat to highest setting.

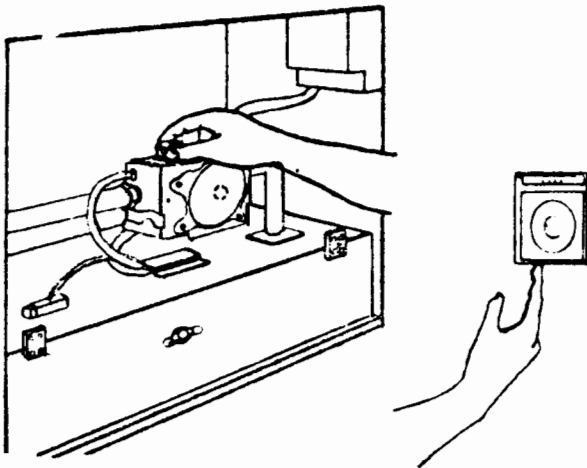
Remove front panel.



**B** Turn gas valve knob to "OFF" position.

Wait 5 minutes.

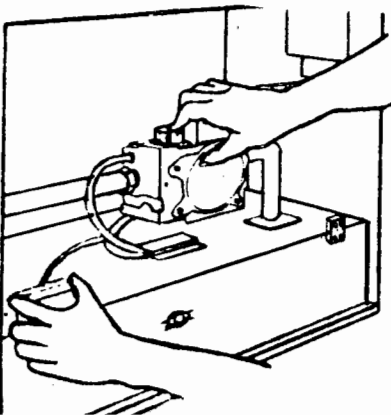
Set switch on thermostat to the "OFF" position.



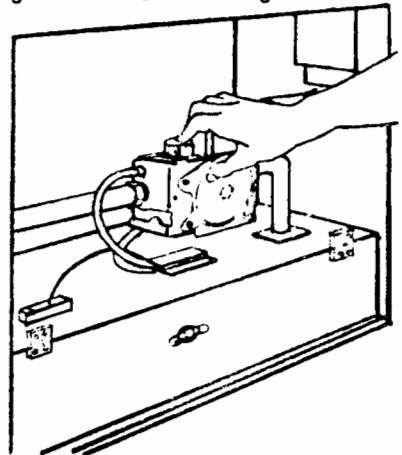
**C** Turn gas valve knob to "PILOT" position.

Depress knob and light pilot by depressing ignitor. Several strokes may be required before pilot gas will ignite.

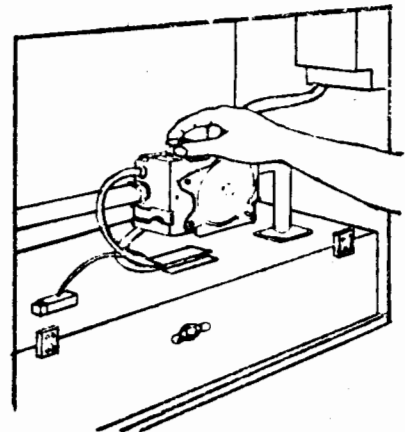
On the initial lighting the pilot may not light immediately due to air in the gas line. If this is the case, it may be necessary to hold the gas control knob in and depress the ignitor several times. **CAUTION:** If pilot has not lit within one minute, release knob. Reset thermostat switch to the "ON" position and allow blower to operate. While blower is operating, depress gas control knob for several minutes. (Blower will purge any gas which enters heat chamber during this period.) Repeat Steps 2 and 3.



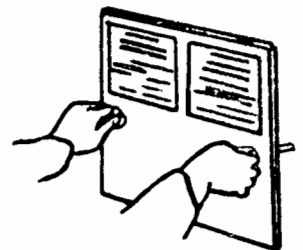
**D** After the pilot is lit, hold the knob in for approximately thirty (30) seconds, or until pilot stays on when knob is released. IF PILOT GOES OUT, repeat Steps 1 through 3, allowing longer time before releasing knob.



**E** Turn gas valve knob to full "ON" position. Correct operation of the unit depends on this valve being in the full "ON" position. Never attempt to operate the unit with valve partially closed.



**F** Replace furnace front panel.



**G** Set thermostat switch to "ON" position and set selector lever to desired temperature. Furnace will now operate automatically.



For complete shut-down, depress gas valve knob and turn to "OFF". Set thermostat to "OFF" setting.

**BEFORE PROCEEDING CHECK ALL CONNECTIONS with a soap solution to detect leaks. This also should include a check of the furnace controls and piping. NEVER CHECK FOR LEAKS WITH A LIGHTED MATCH.**

## 1

### OPERATING INSTRUCTIONS

(Illustrated on page 2)

The piezo electric spark ignitor facilitates lighting. It is a solid state device with no outside current required.

**IMPORTANT:** Failure to follow these lighting instructions exactly may result in damage to the unit.

- A. Set thermostat to highest setting. Remove front panel by pulling straight out.
- B. Turn gas control knob to the "OFF" position. Wait five (5) minutes. (Blower will start and purge any unburned gases from the heat exchanger.)
- C. Set switch on thermostat to the "OFF" position.

Turn gas control knob to "Pilot" position. Depress knob and light pilot by depressing ignitor.

On the initial lighting the pilot may not light immediately due to air in the gas line. If this is the case, it may be necessary to hold the gas control knob in and depress the ignitor several times. **CAUTION:** If pilot has not lit within one minute, release knob. Reset thermostat switch to the "ON" position and allow blower to operate. While blower is operating, depress gas control knob for several minutes. (Blower will purge any gas which enters heat chamber during this period.) Repeat Steps 2 and 3.

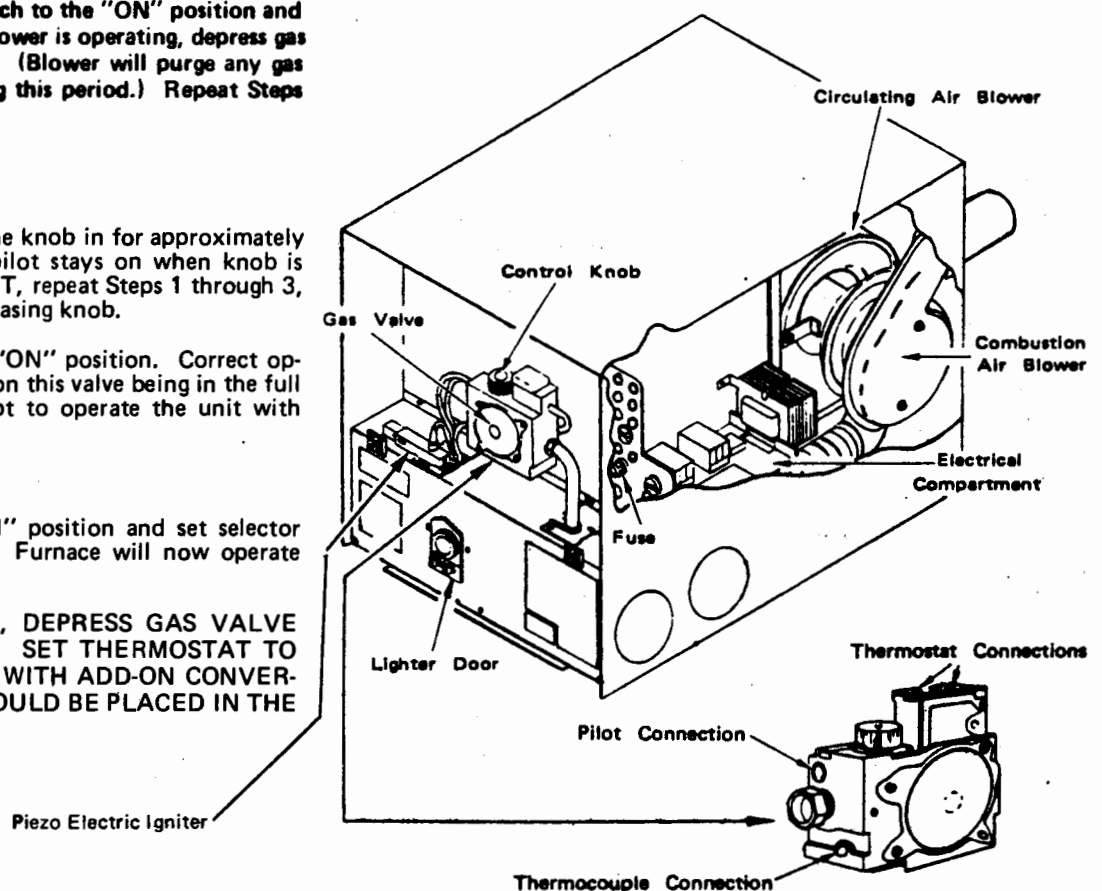
- D. After the pilot is lit, hold the knob in for approximately thirty (30) seconds, or until pilot stays on when knob is released. IF PILOT GOES OUT, repeat Steps 1 through 3, allowing longer time before releasing knob.
- E. Turn gas control knob to full "ON" position. Correct operation of the burner depends on this valve being in the full "ON" position. Never attempt to operate the unit with valve partially closed.
- F. Replace furnace front panel.
- G. Set thermostat switch to "ON" position and set selector lever to desired temperature. Furnace will now operate automatically.

**FOR COMPLETE SHUT DOWN, DEPRESS GAS VALVE KNOB AND TURN TO "OFF". SET THERMOSTAT TO "OFF" SETTING. ON MODELS WITH ADD-ON CONVERTER THE TOGGLE SWITCH SHOULD BE PLACED IN THE "OFF" POSITION."**

## 2

### SEQUENCE OF NORMAL OPERATION

1. When the thermostat calls for heat, the blower motor is energized immediately.
2. As the blower motor reaches approximately 75 percent of the normal r.p.m. (within 1 to 2 seconds) the combustion air switch, in response to the air flow that provides a supply of air for combustion, will engage allowing current flow to the gas valve.
3. The current to the gas valve opens it and allows gas to the main burner. The pilot light then ignites the main burner.
4. If within a period of approximately 1 minute after the main burner is lit, the thermostat is turned back, both the blower motor and gas valve are de-energized. However, if the furnace continues to run longer than 1 minute, which it normally should, a slight snap can be heard from within the casing. The snap is caused by the fan switch as it changes its position. After this occurs, if the thermostat is satisfied or turned back, the gas valve will close, the flame on the main burner will go out, but the blower will continue to run for a short period of time and will then shut off. The purpose of this is to remove most of the remaining gases and heat from the heat exchanger.



### 3

#### COMPONENT PARTS FUNCTION ALL MODELS

##### BLOWER ASSEMBLY

One motor is used to drive both the combustion air and the circulating air blower wheels. Although one motor drives both wheels, the blowers are separate. The combustion-air blower is sealed so as to allow no passage of air between it and the circulating room-air blower. The combustion-air blower draws air from the outside atmosphere, discharges it into the combustion chamber, and forces the combustion products out the exhaust tube. The circulating room-air blower pulls return air in and forces it across the heat chamber, discharging it to the area to be heated.

##### AUTOMATIC SOLID STATE RECTIFIER SYSTEM ON DUAL VOLTAGE MODELS

A step down transformer, in combination with a full wave bridge rectifier, converts 120-volt a.c. to 12-volt d.c.

A double-throw toggle switch can be manually switched to operate the heater on battery power (12 VDC) or from line power if coach is plugged in (120 VAC).

##### FAN SWITCH

The fan switch is to control the sequence of the blower operation. When the bimetal disc of the fan is heated to the operating temperature, the switch closes. This completes a circuit through the motor. The blower will continue to run as long as the chamber is hot even though the thermostat is satisfied and the main burner is off. When the chamber cools, the fan switch changes back to its original position and shuts the blower off.

##### LIMIT SWITCH

The purpose of the limit control is to turn off power to the gas control if the furnace becomes over heated.

If the circulating air is blocked, even partially, the limit control will function and cause the main burner to short cycle. If short cycling exists, the furnace blower and the circulating air system should be thoroughly cleaned.

If the limit control is found to be defective, it can not be repaired. It must be replaced with a new one.

**CAUTION:** Never short across or bypass the Limit Control even for only temporary operation.

##### AIR SWITCH

The combustion air switch has two purposes:

1. It is an "air prover". It operates in response to the current of air generated by the blower. Hence, if for any reason the air from the blower is not sufficient, the switch will not operate. This may be caused by a slow motor due to low voltage, restricted return air, or lint accumulation on the blower wheel.
2. The switch allows time for the blower to pull in sufficient air to support combustion before it engages. Once it engages, the gas valve opens, gas flows to the main burner, and ignition occurs.

### 4

#### MAINTENANCE AND CLEANING

**NOTE:** For continued satisfactory performance of this unit it is necessary that the control compartment be kept clean. Routine inspection, maintenance and cleaning is recommended at least on a yearly basis.

If for any reason the main burner has been allowed to operate with a high yellow flame, a soot formation is sometimes deposited inside the combustion chamber. The carbon deposit may be of such quantity that cleaning will be necessary. In the combustion chamber a vacuum cleaner is ideal to clean out any carbon deposit.

The unit is equipped with an oiled, sealed motor and requires no oiling.

### 5

#### SERVICE HINTS, DIAGNOSIS AND CORRECTIVE MEASURES

##### 1. PROBLEM—NO HEAT

- a. Check electrical supply to make sure that 120-volt a.c. or 12-volt d.c., or both, are available at unit. Battery must be charged. If battery is low, there may be sufficient power to run the blower, but not enough to run the blower at full speed. If blower does not run at its prescribed speed, the combustion air switch cannot engage and gas will not flow to the main burner. Be sure the connections of the voltage lines in the terminal block are tight.

- b. Check fuse located in electrical box. These furnaces use a standard automotive type fuse.

65917 & 65920 — 8 amp.  
65925 & 65930 — 10 amp.

- c. GAS SUPPLY—Be sure manual gas valve is in the open position.

- d. PILOT—Check to be sure pilot is lit (Pilot outage discussed in problem 3).

- e. THERMOSTAT OFF—Check to be sure thermostat is calling for heat. Wire to thermostat could be off terminal.

**f. MALFUNCTIONING COMBUSTION AIR SWITCH**—Be sure the combustion air switch blade is moving far enough to close its contacts. If the switch is not closing, clean any dust or dirt from the actuator pin. Other reasons for switch not operating are:

1. Insufficient air speed (slow motor due to low charged battery, faulty motor, or lint and dust accumulation on the blower wheels, or restriction of return air to furnace.) Check wiring in accordance with unit's wiring diagram to assure the proper polarity of the 12-volt d.c. power supply is observed. This polarity must be observed so the motor will run the proper direction of rotation to insure correct air delivery.
2. Faulty combustion air switch—Replace switch if valve does not open when switch is engaged. Switch should also be replaced if battery is fully charged and blower motor running at top speed fails to engage switch within 3 to 4 seconds.

**NOTE:** To service switch, inner furnace assembly must be removed from outer casing to visually and manually check the switch.

- g. **GAS CONTROL VALVE**—With test light check valve terminals. If current is present, but valve is not opening (when combustion air switch engages), replace control valve.
- h. **BLOWER NOT OPERATING**—Check for burned-out motor. On dual voltage model furnaces, the AC/DC switch could be faulty. If blower operates properly on 12 volt DC but will not operate when 120 volt AC is supplied to vehicle, check switch for proper continuity.
- i. **DEFECTIVE RELAY**—On both types of units, the fan relay could be defective. If this relay does not click when 12 volt DC is applied to terminals A and B, replace relay. If relay does click, but contacts 5 and 7 do not close, replace relay.

## 2. PROBLEM—SHORT CIRCUIT

If fuses are blown either in the furnace or vehicle a short is indicated and should be checked.

- a. Turn off all appliances including furnace.
- b. Install an ammeter on the positive (+) lead of the battery. Amperage reading should be 0. If an amperage reading is noted, a short exists in the vehicle electrical system.
- c. Disconnect the red (+) DC lead at the furnace. If the amperage continues, the short is exterior to the furnace. If the amperage reading ceases, the furnace electrical system is shorted and should be checked.

## 3. PROBLEM—PILOT OUTAGE

Trouble shooting for pilot outage problems on this model is greatly simplified if it can be determined at what time the pilot goes out during the heating cycle. Outage which occurs during one part of the cycle usually has a different cause than outage which occurs during another part of the cycle.

**A. "OFF" CYCLE**—Main burner and blower not operating:

1. **AIR LEAKAGE**—Draft should not affect the pilot. The unit has a sealed combustion chamber with an air intake and exhaust subject to the same atmospheric pressure. Therefore, the pressure within the chamber is equalized and air is steady. Regardless of the wind or draft condition, the pilot will not be blown out as long as the chamber is sealed properly. If, however, a leak is evident anywhere in the sealed combustion system, it would disrupt the pressurized chamber and an air movement would commence. As a result, the pilot could possibly go out.

The following points should be checked carefully for air leakage.

- a. Combustion air pipe and exhaust pipe connections to the furnace. The outer pipe should project into the furnace at least 1¼" and the connection should be snug. If this is not the case, replace the vent assembly with one having longer pipes (available from Duo-Therm).
- b. The flex air duct which connects the combustion air blower and the heat chamber must have tight connections. If the flex air duct is damaged, replace it.
- c. It is very important that all gaskets in the sealed combustion system be tight. Gaskets which become damaged during repair of unit should be replaced. Complete gasket sets are available and include all gaskets for the sealed combustion system.

**2. REVERSED VENT CAPS**—The two outside vent caps appear identical with one exception—a small cone shaped ring attached to the exterior of the exhaust cap. It is absolutely necessary that this ring is on the exhaust side and not on the intake side. Due to the similarity of these caps, it is possible for them to become reversed during reinstallation.

**3. PILOT ADJUSTMENT**—Pilot should be adjusted to where the pilot flame just envelopes the thermocouple tip. This is best accomplished by using a millivolt meter. Pilot should be adjusted to obtain a minimum millivolt reading of 10 millivolts. Unlike most heating equipment, too large a pilot flame in this unit will cause pilot outage. A limited amount of air is circulating through the heat chamber during the off cycle and if the pilot is too large, this air will not be sufficient to support combustion.

**4. LEAKING GAS CONTROL**—If gas leaks through the gas control during the off cycle, it will burn, using up the oxygen in the chamber and causing the pilot to go out. Observe the main burner through the lighter door to be sure that the burner cuts off completely on the off cycle. If any flame is present on the burners, it indicates that a small amount of gas is leaking through. If there is any leakage, replace the gas control.

**5. GAS SUPPLY**—Check gas pressure with a manometer. Proper operating pressure for this system is 11" water column. Low gas pressure will cause the pilot flame to become smaller thus creating a low millivolt output from the thermocouple, and may cause an outage.

## 6

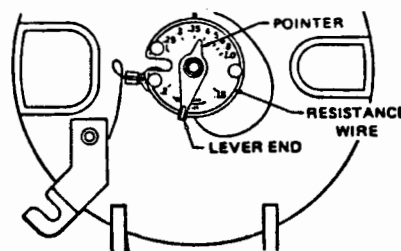
### THERMOSTAT ADJUSTMENT

This unit is equipped with an adjustable thermostat. Improper setting of the heat anticipator can cause either abnormally short or long heating cycles resulting in discomfort.

For correct heating anticipator adjustment, proceed as follows:

Cycle system to determine if cycling rate is satisfactory. If adjustment is necessary, move pointer to a higher setting for longer "ON" cycle and to a lower setting for shorter "ON" cycle.

Suggested normal settings: 65900 Series (Pilot Models) .3



## B. BLOWER OPERATION CYCLE—Main burner on:

1. Air leakage in sealed combustion system. If main burner flame is floating or blowing off of burners, this indicates improper air flow through the heat chamber. Check for air leakage at flex air duct connections, flue pipe and air intake pipe connections, or at any gaskets in the heat chamber assembly. If flex air duct or gaskets are damaged they should be replaced. A floating main burner flame can also be caused by lack of combustion air due to a loose combustion air blower wheel or a poor connection at the air intake pipe. Also check for any restriction in the combustion air intake pipe, the combustion blower, and the flex air duct.
2. If main burner flame burns normally and a complete outage occurs during the operating cycle, it may indicate a weak thermocouple or an incorrect pilot flame due to improper pilot adjustment or low gas pressure. Pilot flame should be adjusted to completely cover at least 3/8" of the thermocouple tip. If the pilot burner hood is not properly located, it may be necessary to adjust the hood to direct the flame at the thermocouple. If the pilot hood is adjusted, it may also be necessary to reposition the ignitor electrode to provide proper spark. If a millivolt meter is used to check thermocouple output, a minimum reading of 10 millivolts must be maintained with the blower operating.
3. If the pilot burner flame diminishes when the main burner comes on, it indicates a pressure drop in the gas supply to the furnace. This is usually caused by a defective tank regulator, a restriction in the gas supply lines or a restriction in the gas control itself. Gas pressure should be checked at the pressure tap provided on the gas control in the furnace.

## C. BLOWER OPERATION CYCLE—Main burner off:

1. If outage occurs with the blower operating and the main burner off, this indicates a weak thermocouple or improper pilot flame due to incorrect pilot adjustment or low gas pressure. Refer to item B above.
2. If the wall thermostat is short cycling, it will cause the system to shut down, before there is sufficient heat build up to close the fan switch. This will cause the blower to shut off at the same time that the main burner shuts off. This allows products of combustion to remain in the heat chamber and may cause pilot failure due to a lack of fresh air. In this event, the thermostat calibration should be checked and the thermostat replaced if necessary. In certain cases, the gas control will draw excessive amperage, thereby, causing the thermostat heat anticipator to open the thermostat prematurely. Check the amperage of the gas control with a DC ammeter and compare to the rated amperage stamped on the gas control body.

# 7

## HIGH ALTITUDE OPERATION

When the unit is operated at altitudes higher than 4000 ft. above sea level, the gas input to the burners should be reduced 4% for each 1000 ft. above sea level.

Failure to derate properly will cause inefficient operation of the burner, and could create carbon monoxide fumes. Re-entry of these fumes into the vehicle (due to improper installation, or through another opening in the coach) could endanger the life of anyone exposed to these fumes for a period of time.

## ORIFICE GUIDE FOR ALTITUDE DERATING

| Altitude<br>In<br>Feet | Models<br>65917<br>65925 | Models<br>65920<br>65930<br>65940 |
|------------------------|--------------------------|-----------------------------------|
| 0-4500                 | No. 66                   | No. 63                            |
| 5000                   | No. 68                   | No. 65                            |
| 6000                   | No. 69                   | No. 66                            |
| 7000                   | No. 69                   | No. 66                            |
| 8000                   | No. 69                   | No. 67                            |
| 9000                   | No. 70                   | No. 67                            |
| 10,000                 | No. 70                   | No. 68                            |
| 11,000                 | No. 71                   | No. 69                            |
| 12,000                 | No. 71                   | No. 69                            |

IF ANY ORIGINAL WIRE HAS TO BE REPLACED, IT MUST BE REPLACED WITH EQUIVALENT WIRE, INSULATION AND TEMPERATURE RATING.

FACTORY WIRING:      FIELD WIRING:

— Low Voltage      --- 12 VDC  
— 120 VAC      --- 120 VAC

WIRING DIAGRAM FOR  
OPTIONAL CONVERTER  
KIT INSTALLATION

12 VDC

JCT. BOX

YEL

RED

120 VAC 18 60 HZ

WHT

BLK

YEL

RED

WHT

12V

OFF

120 VAC

AC

RECT.

FURNACE DC POWER LEADS

Sail Sw.

Limit Sw.

GAS CONTROL

Fan Sw.

ORN

BLU

RED

YEL

BLU

WHT

5

7

A

B

Fan Relay

ORN

Wire Nut

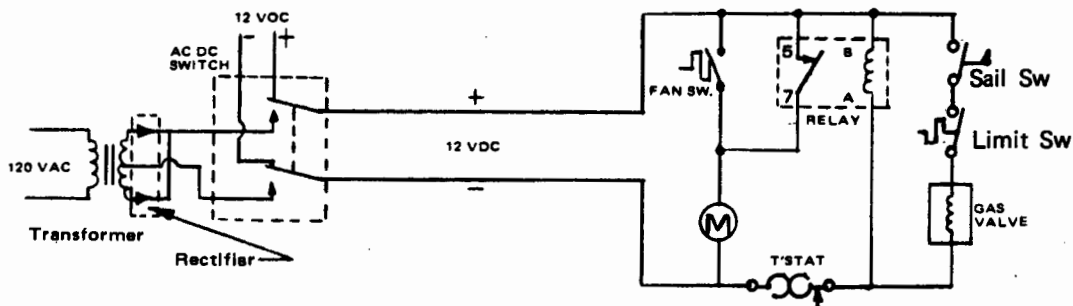
Blower Motor

RED

BLK

|                        |                      |
|------------------------|----------------------|
| <b>FACTORY WIRING:</b> | <b>FIELD WIRING:</b> |
| ———— Low Voltage       | — — — 12 VDC         |
| ———— 120 VAC           | — — — 120 VAC        |

## WIRING SCHEMATIC FOR OPTIONAL CONVERTER



### WIRING SCHEMATIC FOR ABOVE WIRING DIAGRAM